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AN ANTI-PREDATOR BEHAVIOR IN LARVAE OF *LIBYTHEANA CARINENTA* (NYMPHALIDAE, LIBYTHEINAE)

Additional key words: ant-predation, *Celtis*, frass chains.

Strategies of avoiding predators are well documented in larvae of Lepidoptera, and include a variety of morphological, chemical and behavioral traits (Malicky 1970, Brower 1984, Heads & Lawton 1985, Stamp & Casey 1993, Freitas & Oliveira 1992, 1996, Loeffler 1996). One rather unusual behavioral defense found in larvae of species of Charaxinae and Limenitidinae is the construction of frass chains (DeVries 1987, Freitas & Oliveira 1996). Frass chains are stick-like structures formed by fecula and silk where the larvae rest when not feeding, and provide an efficient refuge against predation by "walking" arthropod predators by isolating the larvae from the leaf blade when not feeding (Freitas & Oliveira 1996). In this note, a similar behavior is reported in larvae of the Libytheinae *Libytheana carinenta* (Cr.) at two sites in southeastern Brazil.

Field observations were conducted in two fragments of deciduous forests in São Paulo state; the "Fazenda Três Barras", in Castilho, in February 1995 and in the "Reserva da Mata Santa Genebra", Campinas, in March 1997, March–April 1998 and March–April 1999. The larvae were observed feeding on *Celtis iguanae* (Ulmaceae) in Castilho, and on *C. spinosa* in Campinas.

Larvae of *Libytheana carinenta* were observed resting on the midvein of partially eaten leaves of *Celtis* spp. (Fig. 1). This behavior was observed in all instars, being present even in fully grown fifth instar larvae. Most of the observed eggs (n > 50) were laid individually on very young leaves (with five observations of eggs on spines on the shoot tips), and larvae start to eat alongside the central vein just after hatching, resulting in the formation of the stick-like structure on the expanding leaf. Larvae rest on the tip of this structure, returning to the leaf blade only for eating. No larvae of *L. carinenta* were observing feeding asymmetricaly on the leaf tip, or on only one side of the leaf.

Although *Celtis spinosa* does not bear extrafloral nectaries, ants were frequently seen on branches and leaves of *Celtis* spp. in forest edges. In this habitat ants commonly associate with Homoptera, especially on shoot tips, and were observed preying on small moth caterpillars, suggesting that they could be effective predators of butterfly larvae as well. As also recorded by Freitas and Oliveira (1996) for another ant-butterfly interaction, these and other ants were never observed climbing onto *L. carinenta*'s stick-like

Fig. 1. Third instar larva of *Libytheana carinenta* resting in the remaining central vein of a *Celtis spinosa* leaf.

structures. Therefore the behavior of constructing and resting on these structures may provide a refuge against ant predation on the host plant, and in this way could be analogous to the behavior of resting on frass chains, observed in the Eurytelinae, Charaxinae and Heliconiinae.

Considering Libytheinae as the most basal lineage of Nymphalidae (Harvey 1991), the results presented here could be important to the understanding of the anti-predator strategies present in other Nymphalidae. For example, in the Limenitidinae different degrees of complexity of similar refuges are known, ranging from the simple remaining midvein (as described in the present paper) to true frass chains, with several known variations (Morrell 1954, Fukuda et al. 1972).

Data on larval biology of Libytheinae are scarce, and no defensive strategies have been reported, making this the first report of a defensive behavior in Libytheinae larvae. Similar simple structures are present in larvae of several moth species in different areas of tropical forests in Brazil, as well as in the pierid genus *Dismorphia* (Brown 1992), and in some Heliconiini, that construct or leave island-like structures on leaf edges (Benson et al. 1975) which were considered to be analogous to the frass-chains (see discussion in Freitas & Oliveira 1996). All these behaviors represent different ways for the larvae to maintain themselves isolated from the leaf blade; their occurrence in several different lineages of Lepidoptera shows that the fixation of this trait in many cases could be explained by predation pressure.

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